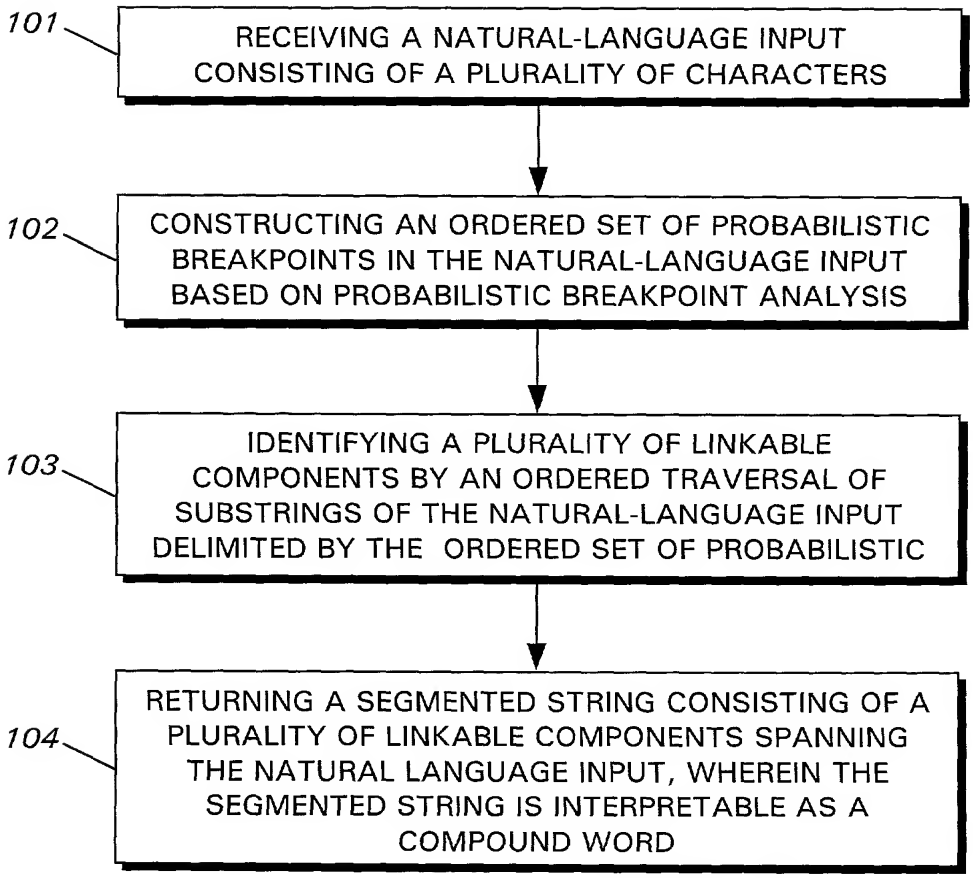

FIG. 1

Google Exhibit 1009
Page 1 of 22

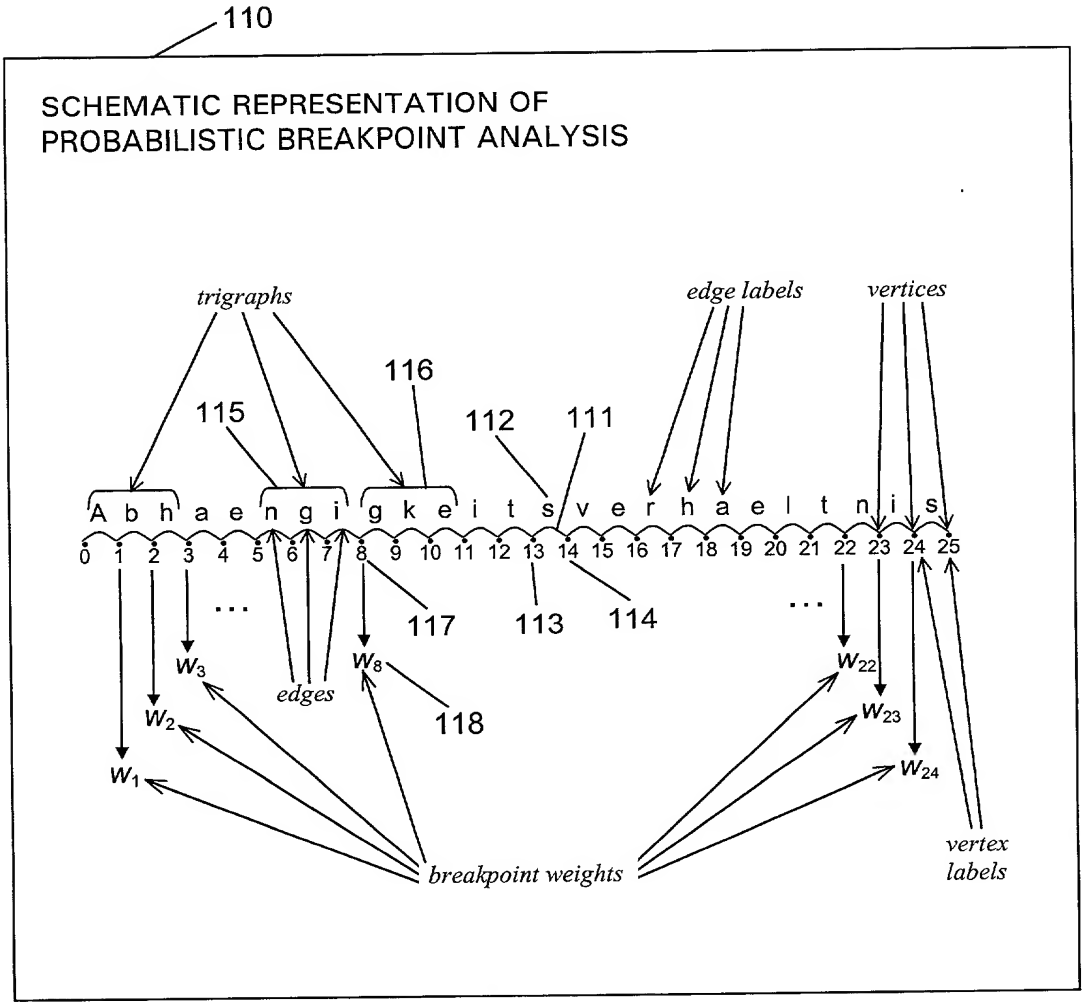
110
SCHEMATIC REPRESENTATION OF PROBABILISTIC BREAKPOINT ANALYSIS
trigraphs
edge labels
vertices
116
115
112
111
A b h a e n g i g k e i t s v e r h a e l t n i s
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
117
113
114
edges
118
W1
W2
W3
W8
W22
W23
W24
breakpoint weights
vertex labels

FIG. 2

```
ANALYZING:  Abhaengigkeitsverhaeltnis

 3:    Abh+aen      END = 0       START = 103     TOTAL = 103     9
 4:    bha+eng      END = 3       START = 380     TOTAL = 383     6
 5:    hae+ngi      END = 2       START = 0       TOTAL = 2      18
 6:    aen+gig      END = 30      START = 49      TOTAL = 79     10
 7:    eng+igk      END = 15      START = 0       TOTAL = 15     14
 8:    ngi+gke      END = 3       START = 0       TOTAL = 3      17
 9:    gig+kei      END = 70      START = 219     TOTAL = 289     7
10:    igk+eit      END = 2       START = 104     TOTAL = 106     8
11:    gke+its      END = 0       START = 0       TOTAL = 0      20
12:    kei+tsv      END = 13      START = 0       TOTAL = 13     15
13:    eit+sve      END = 3005    START = 12      TOTAL = 3017    2
14:    its+ver      END = 123     START = 31722   TOTAL = 31845   1
15:    tsv+erh      END = 0       START = 633     TOTAL = 663     5
16:    sve+rha      END = 0       START = 7       TOTAL = 7      16
17:    ver+hae      END = 301     START = 733     TOTAL = 1034    4
18:    erh+ael      END = 1       START = 45      TOTAL = 46     12
19:    rha+elt      END = 5       START = 70      TOTAL = 75     11
20:    hae+ltn      END = 2       START = 0       TOTAL = 2      19
21:    ael+tni      END = 17      START = 0       TOTAL = 17     13
22:    elt+nis      END = 1915    START = 50      TOTAL = 1965    3
```

FIG. 3

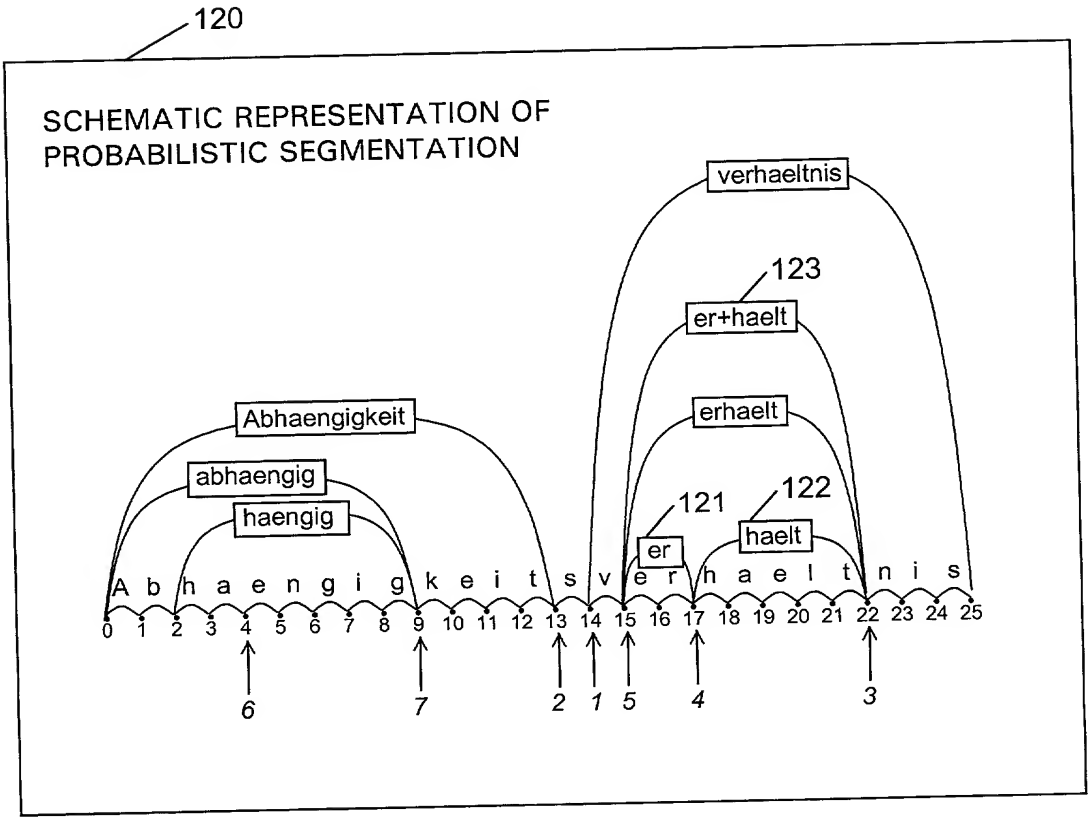
120
SCHEMATIC REPRESENTATION OF PROBABILISTIC SEGMENTATION
verhaeltnis
123
er+haelt
erhaelt
Abhaengigkeit
abhaengig
haengig
121
122
er
haelt
A b h a e n g i g k e i t s v e r h a e l t n i s
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
6
7
2
1
5
4
3

FIG. 4

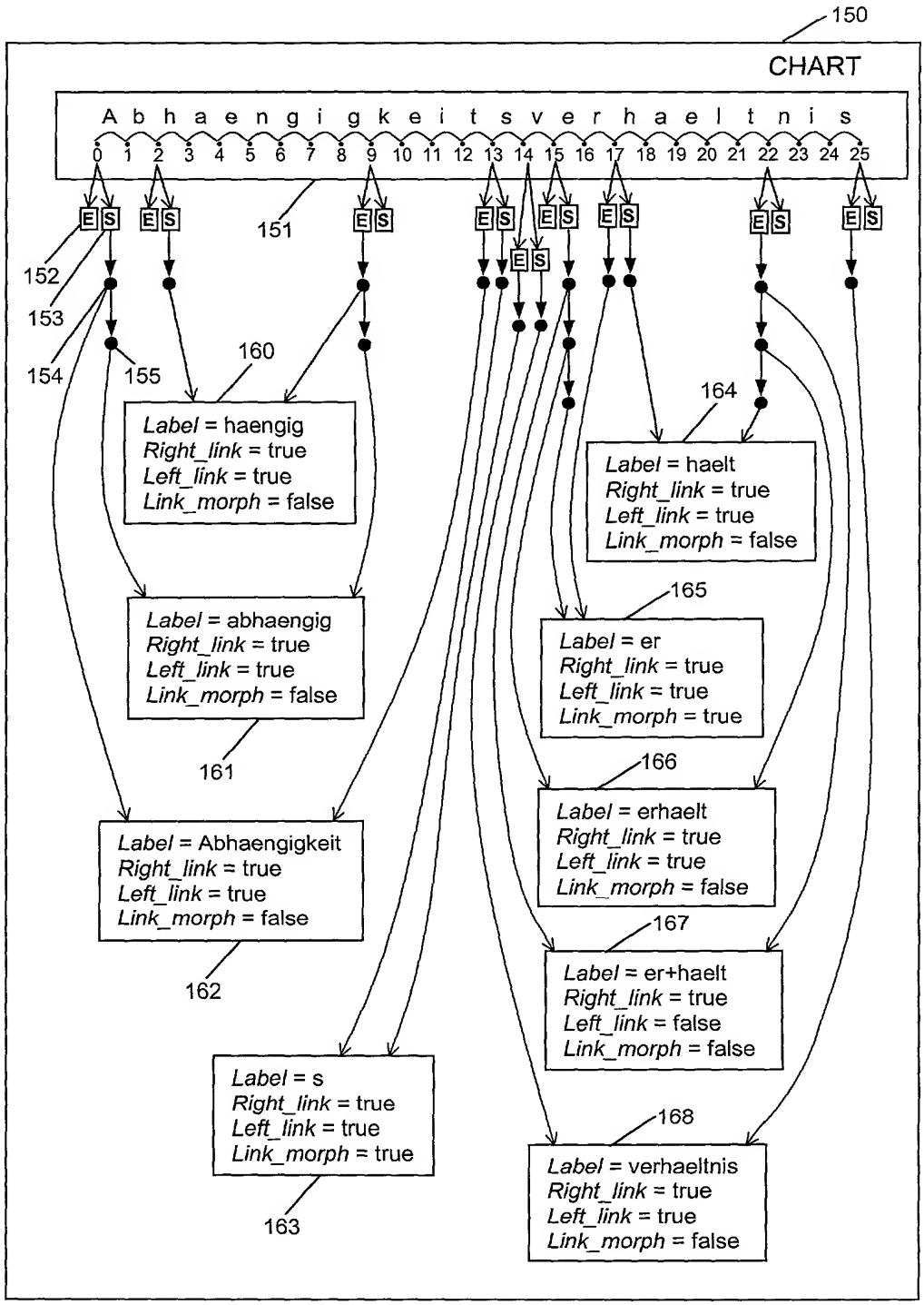
150
CHART
A b h a e n g i g k e i t s v e r h a e l t n i s
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
E S
151
152
153
154
155
160
161
162
163
164
165
166
167
168
Label = haengig
Right_link = true
Left_link = true
Link_morph = false
Label = abhaengig
Right_link = true
Left_link = true
Link_morph = false
Label = Abhaengigkeit
Right_link = true
Left_link = true
Link_morph = false
Label = s
Right_link = true
Left_link = true
Link_morph = true
Label = haelt
Right_link = true
Left_link = true
Link_morph = false
Label = er
Right_link = true
Left_link = true
Link_morph = true
Label = erhaelt
Right_link = true
Left_link = true
Link_morph = false
Label = er+haelt
Right_link = true
Left_link = false
Link_morph = false
Label = verhaeltnis
Right_link = true
Left_link = true
Link_morph = false

FIG. 5

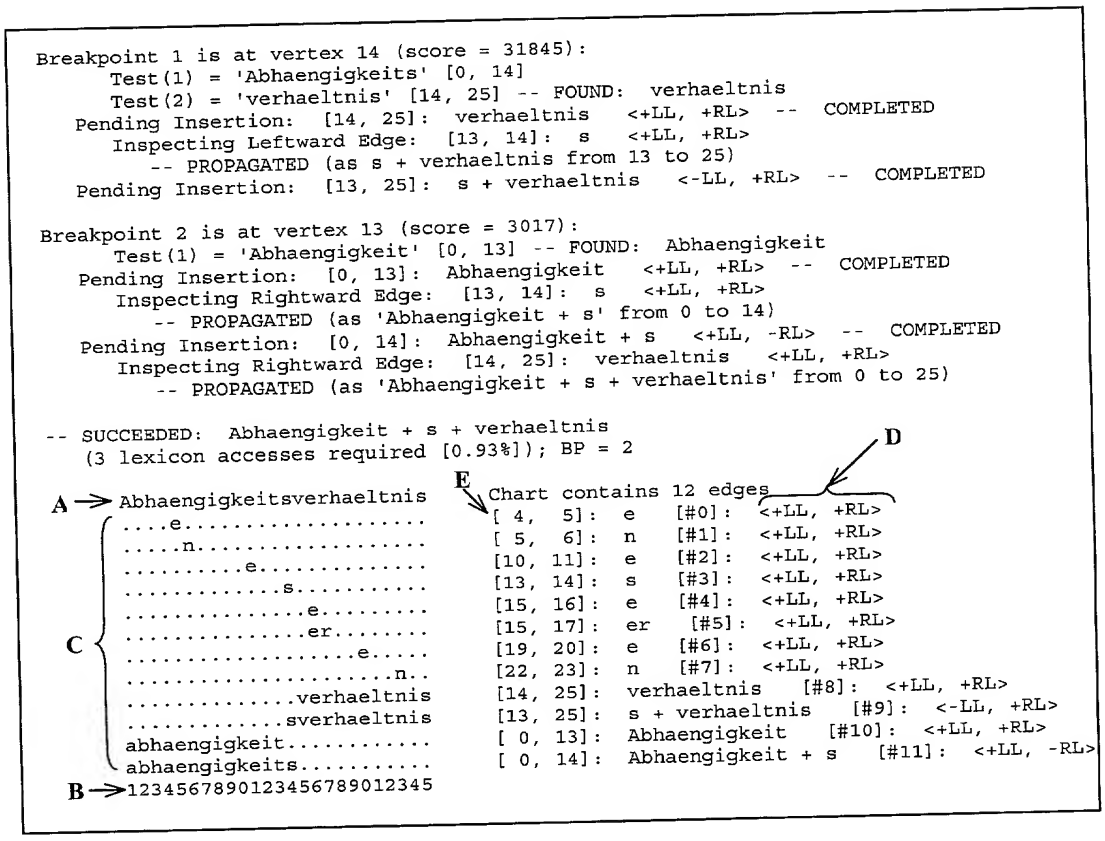
Breakpoint 1 is at vertex 14 (score = 31845):
Test(1) = 'Abhaengigkeits' [0, 14]
Test(2) = 'verhaeltnis' [14, 25] -- FOUND: verhaeltnis
Pending Insertion: [14, 25]: verhaeltnis <+LL, +RL> -- COMPLETED
Inspecting Leftward Edge: [13, 14]: s <+LL, +RL>
-- PROPAGATED (as s + verhaeltnis from 13 to 25)
Pending Insertion: [13, 25]: s + verhaeltnis <-LL, +RL> -- COMPLETED
Breakpoint 2 is at vertex 13 (score = 3017):
Test(1) = 'Abhaengigkeit' [0, 13] -- FOUND: Abhaengigkeit
Pending Insertion: [0, 13]: Abhaengigkeit <+LL, +RL> -- COMPLETED
Inspecting Rightward Edge: [13, 14]: s <+LL, +RL>
-- PROPAGATED (as 'Abhaengigkeit + s' from 0 to 14)
Pending Insertion: [0, 14]: Abhaengigkeit + s <+LL, -RL> -- COMPLETED
Inspecting Rightward Edge: [14, 25]: verhaeltnis <+LL, +RL>
-- PROPAGATED (as 'Abhaengigkeit + s + verhaeltnis' from 0 to 25)
-- SUCCEEDED: Abhaengigkeit + s + verhaeltnis
(3 lexicon accesses required [0.93%]); BP = 2
A
Abhaengigkeitsverhaeltnis
C
....e.....
.....n.....
.....e.....
.....s.....
.....e.....
.....er.....
.....e.....
.....n..
.....verhaeltnis
.....sverhaeltnis
abhaengigkeit.....
abhaengigkeits.....
B
123456789012345678901234 5
E
Chart contains 12 edges
D
[4, 5]: e [#0]: <+LL, +RL>
[5, 6]: n [#1]: <+LL, +RL>
[10, 11]: e [#2]: <+LL, +RL>
[13, 14]: s [#3]: <+LL, +RL>
[15, 16]: e [#4]: <+LL, +RL>
[15, 17]: er [#5]: <+LL, +RL>
[19, 20]: e [#6]: <+LL, +RL>
[22, 23]: n [#7]: <+LL, +RL>
[14, 25]: verhaeltnis [#8]: <+LL, +RL>
[13, 25]: s + verhaeltnis [#9]: <-LL, +RL>
[0, 13]: Abhaengigkeit [#10]: <+LL, +RL>
[0, 14]: Abhaengigkeit + s [#11]: <+LL, -RL>

FIG. 6

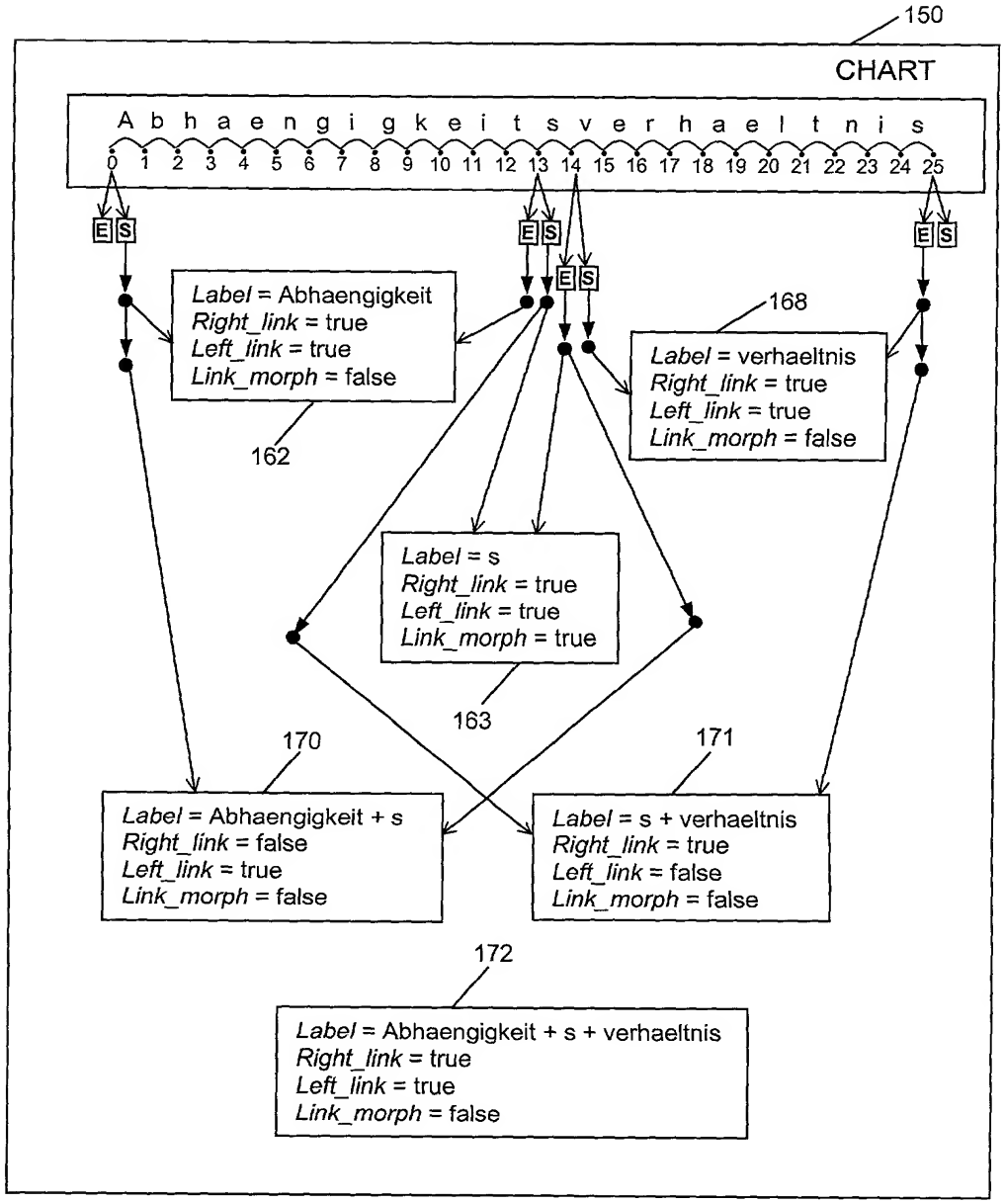

FIG. 7

10042528 - 102301

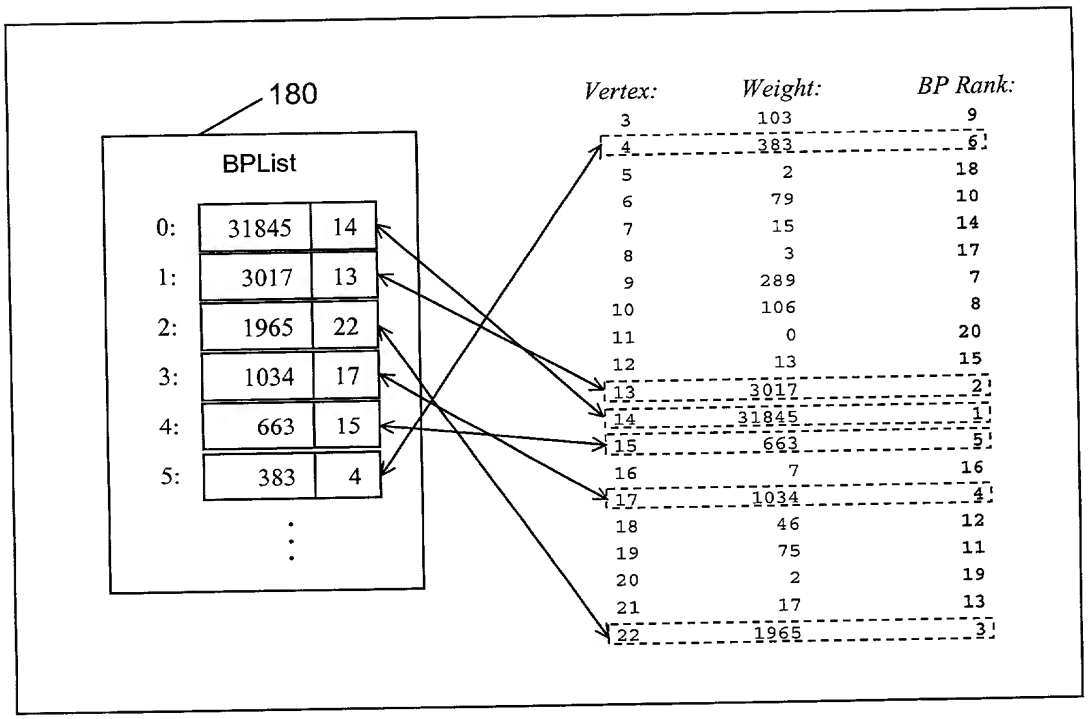
180
BPList
0: 31845 14
1: 3017 13
2: 1965 22
3: 1034 17
4: 663 15
5: 383 4
Vertex: Weight: BP Rank:
3 103 9
4 383 6
5 2 18
6 79 10
7 15 14
8 3 17
9 289 7
10 106 8
11 0 20
12 13 15
13 3017 2
14 31845 1
15 663 5
16 7 16
17 1034 4
18 46 12
19 75 11
20 2 19
21 17 13
22 1965 3

FIG. 8

```
FAILED:  Geschwerkschaftsorganisation
Best guess is:  {Gesch} Werk + schaft + s + Organisation
(116 lexicon accesses required (28.64%)); BP = 18

Geschwerkschaftsorganisation     Chart contains 32 edges
.....werk ..................     [ 5,  9]:  Werk   [#2552]:  <+LL, +RL>
.....werks..................     [ 5, 10]:  Werk + s   [#2553]:  <+LL, -RL>
.....werks..................     [ 5, 10]:  Werks   [#2554]:  <+LL, +RL>
.........schaft.............     [ 9, 15]:  schaft   [#2555]:  <+LL, +RL>
.........schafts............     [ 9, 16]:  schaft + s   [#2556]:  <+LL, -RL>
.....werkschafts............     [ 5, 16]:  Werk + schaft + s   [#2557]:  <+LL, -RL>
.....werkschaft.............     [ 5, 15]:  Werk + schaft   [#2558]:  <+LL, +RL>
...............organisation    [16, 28]:  Organisation   [#2560]:  <+LL, +RL>
..............sorganisation    [15, 28]:  s + Organisation   [#2561]:  <-LL, +RL>
.........schaftsorganisation    [ 9, 28]:  schaft + s + Organisation   [#2562]:  <+LL, +RL>
.....werkschaftsorganisation    [ 5, 28]:  Werk + schaft + s + Organisation   [#2563]:  <+LL, +RL>
..................gani.......    [18, 22]:  Gani   [#2565]:  <+LL, +RL>
..................ganis......    [18, 23]:  Gani + s   [#2566]:  <+LL, -RL>
...........haft.............    [11, 15]:  Haft   [#2567]:  <+LL, +RL>
...........hafts............    [11, 16]:  Haft + s   [#2568]:  <+LL, -RL>
...........haftsorganisation    [11, 28]:  Haft + s + Organisation   [#2569]:  <+LL, +RL>
...................anis......    [19, 23]:  Anis   [#2570]:  <+LL, +RL>
...............organ........    [16, 21]:  Organ   [#2571]:  <+LL, +RL>
..............sorgan........    [15, 21]:  s + Organ   [#2572]:  <-LL, +RL>
.........schaftsorgan........    [ 9, 21]:  schaft + s + Organ   [#2573]:  <+LL, +RL>
.....werkschaftsorgan........    [ 5, 21]:  Werk + schaft + s + Organ   [#2574]:  <+LL, +RL>
...........haftsorgan........    [11, 21]:  Haft + s + Organ   [#2576]:  <+LL, +RL>
..schwer.....................    [ 2,  8]:  schwer   [#2577]:  <+LL, +RL>
.eschwer.....................    [ 1,  8]:  e + schwer   [#2578]:  <-LL, +RL>
123456789012345678901234567
```

FIG. 9

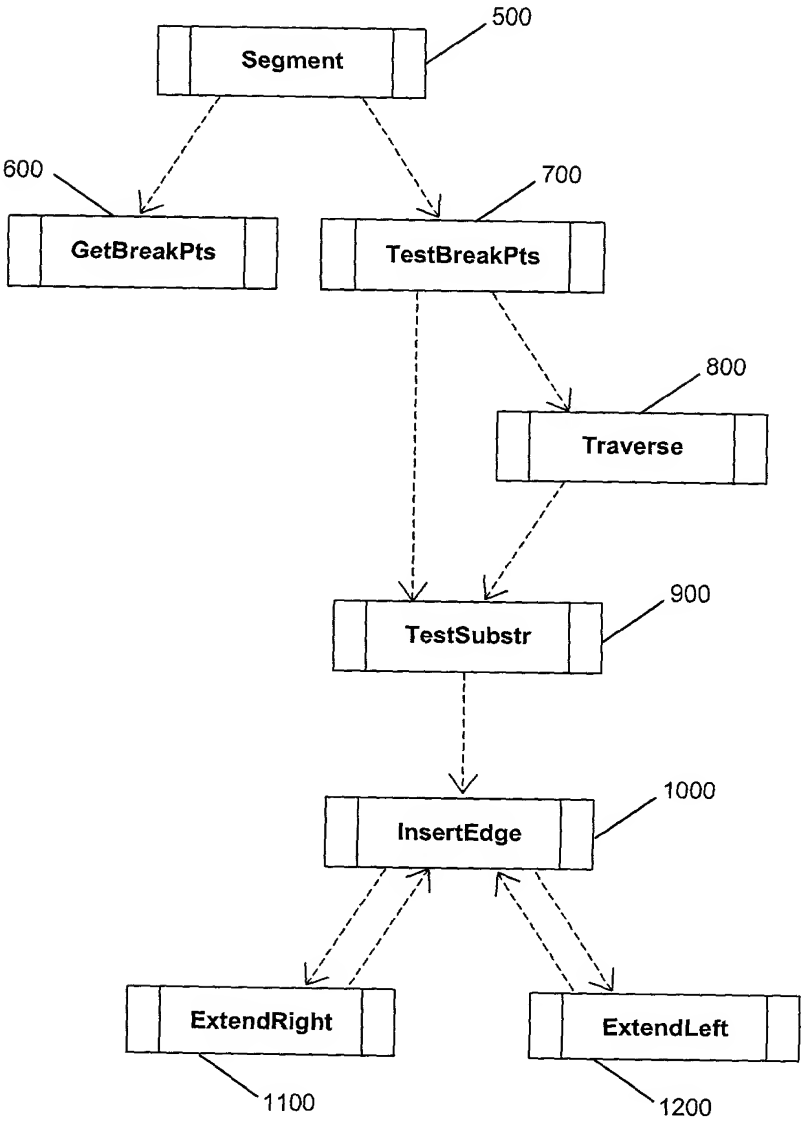
Segment
500
600
GetBreakPts
700
TestBreakPts
800
Traverse
TestSubstr
900
InsertEdge
1000
ExtendRight
1100
ExtendLeft
1200

FIG. 10

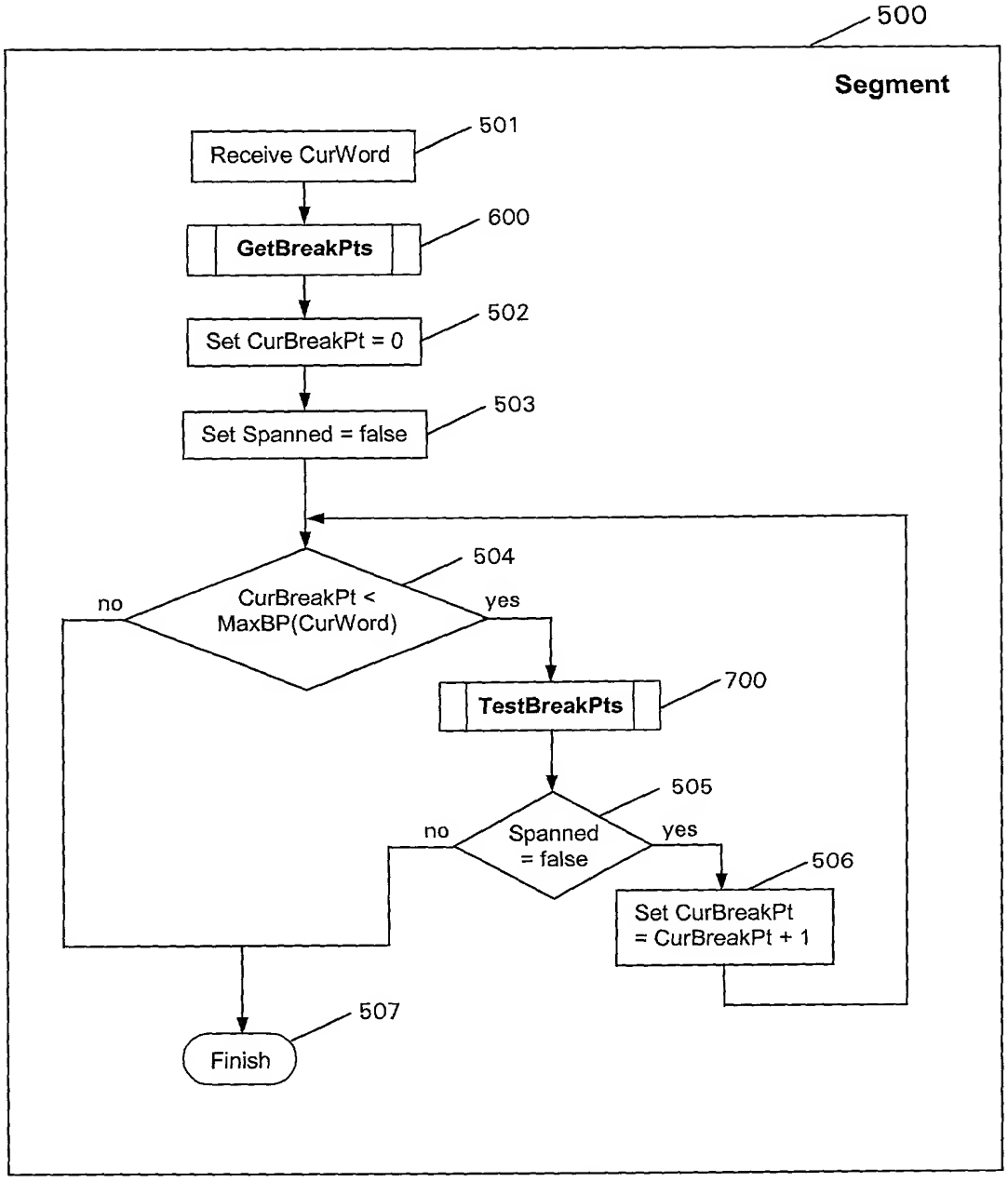
500
Segment
501
Receive CurWord
600
GetBreakPts
502
Set CurBreakPt = 0
503
Set Spanned = false
504
CurBreakPt < MaxBP(CurWord)
no
yes
700
TestBreakPts
505
Spanned = false
no
yes
506
Set CurBreakPt = CurBreakPt + 1
507
Finish

FIG. 11

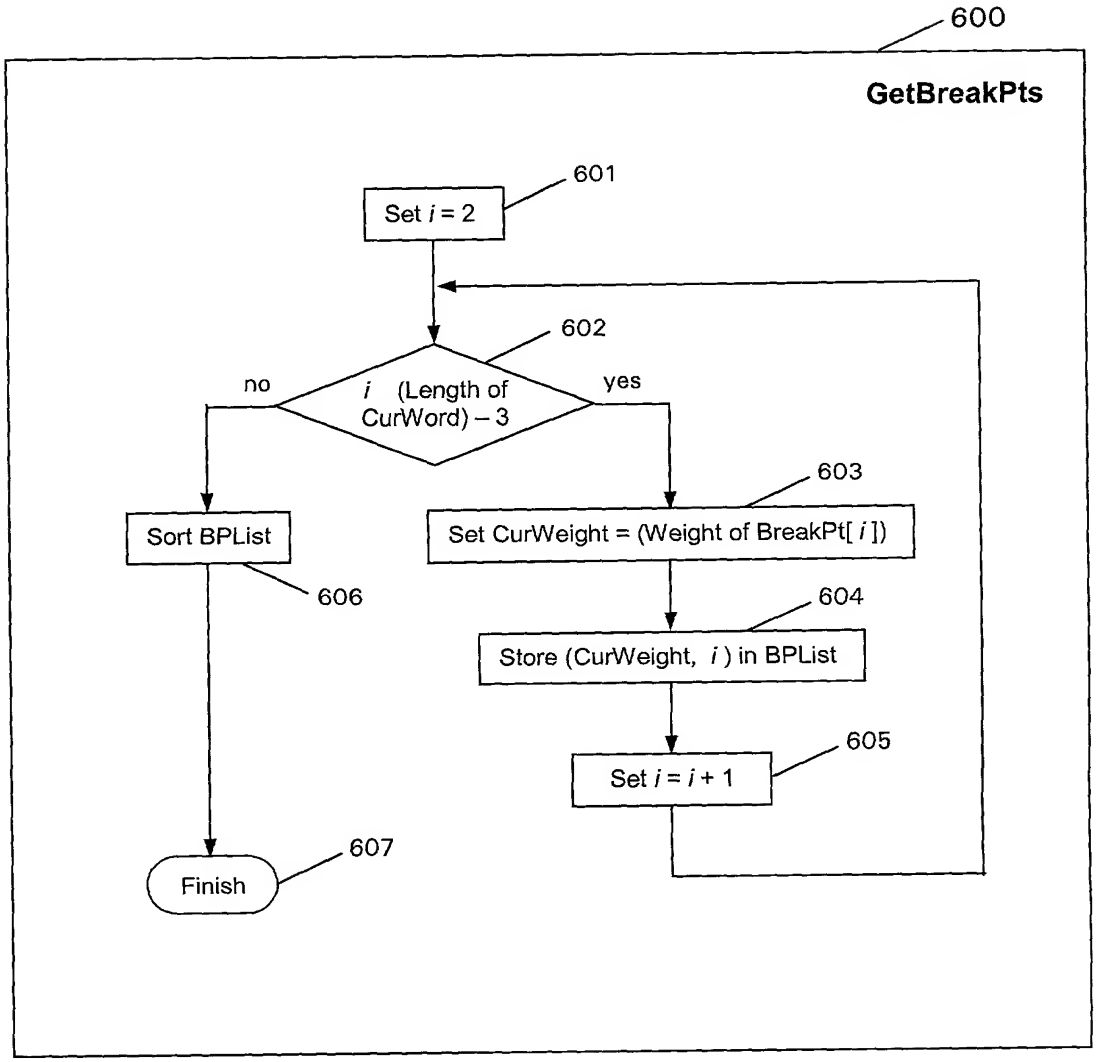
600
GetBreakPts
601
Set i = 2
602
i (Length of CurWord) – 3
no
yes
603
Set CurWeight = (Weight of BreakPt[i])
604
Store (CurWeight, i) in BPList
605
Set i = i + 1
606
Sort BPList
607
Finish

FIG. 12

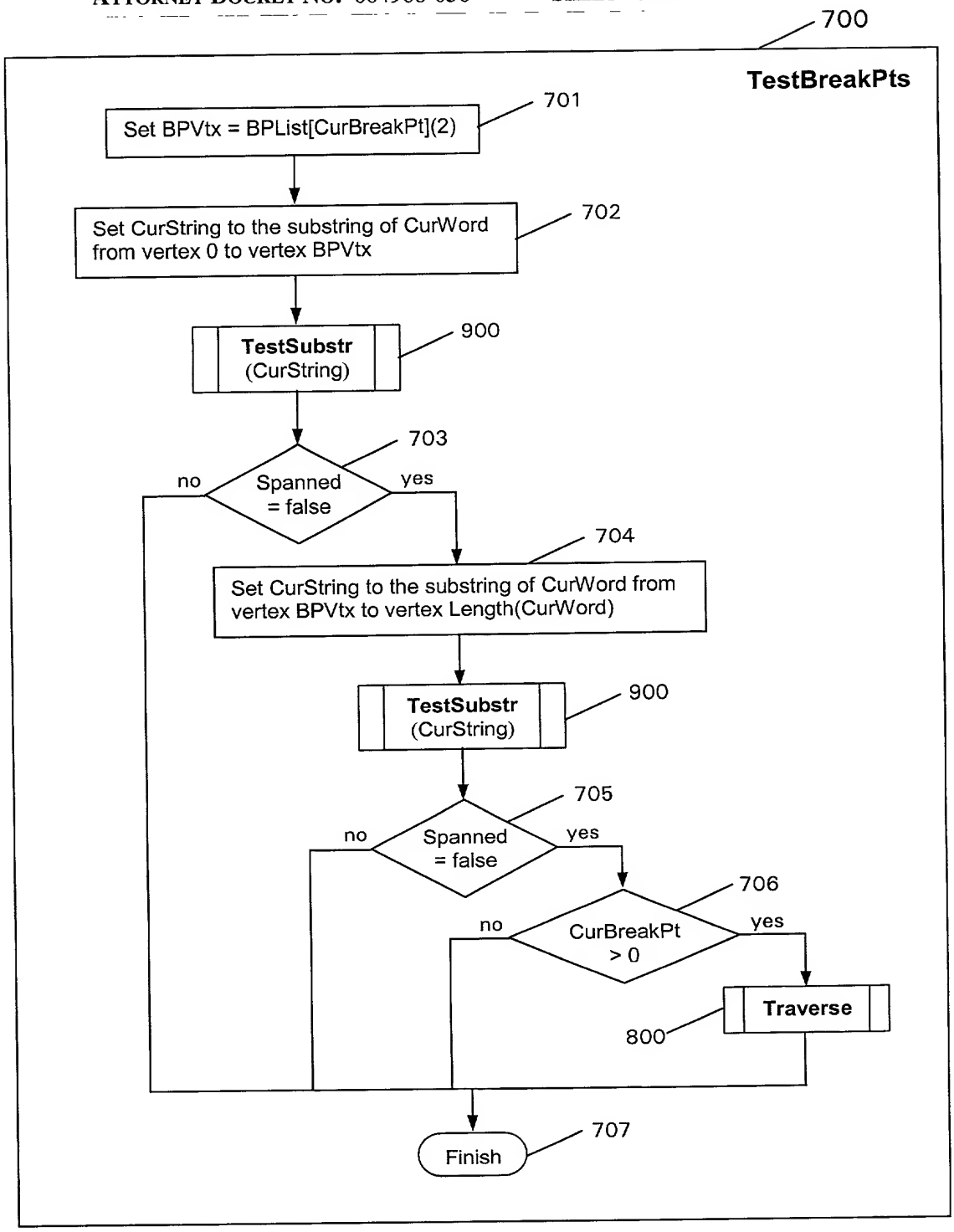
700
TestBreakPts
Set BPVtx = BPList[CurBreakPt](2)
701
Set CurString to the substring of CurWord from vertex 0 to vertex BPVtx
702
TestSubstr (CurString)
900
703
Spanned = false
no
yes
704
Set CurString to the substring of CurWord from vertex BPVtx to vertex Length(CurWord)
TestSubstr (CurString)
900
705
Spanned = false
no
yes
706
CurBreakPt > 0
no
yes
Traverse
800
Finish
707

FIG. 13

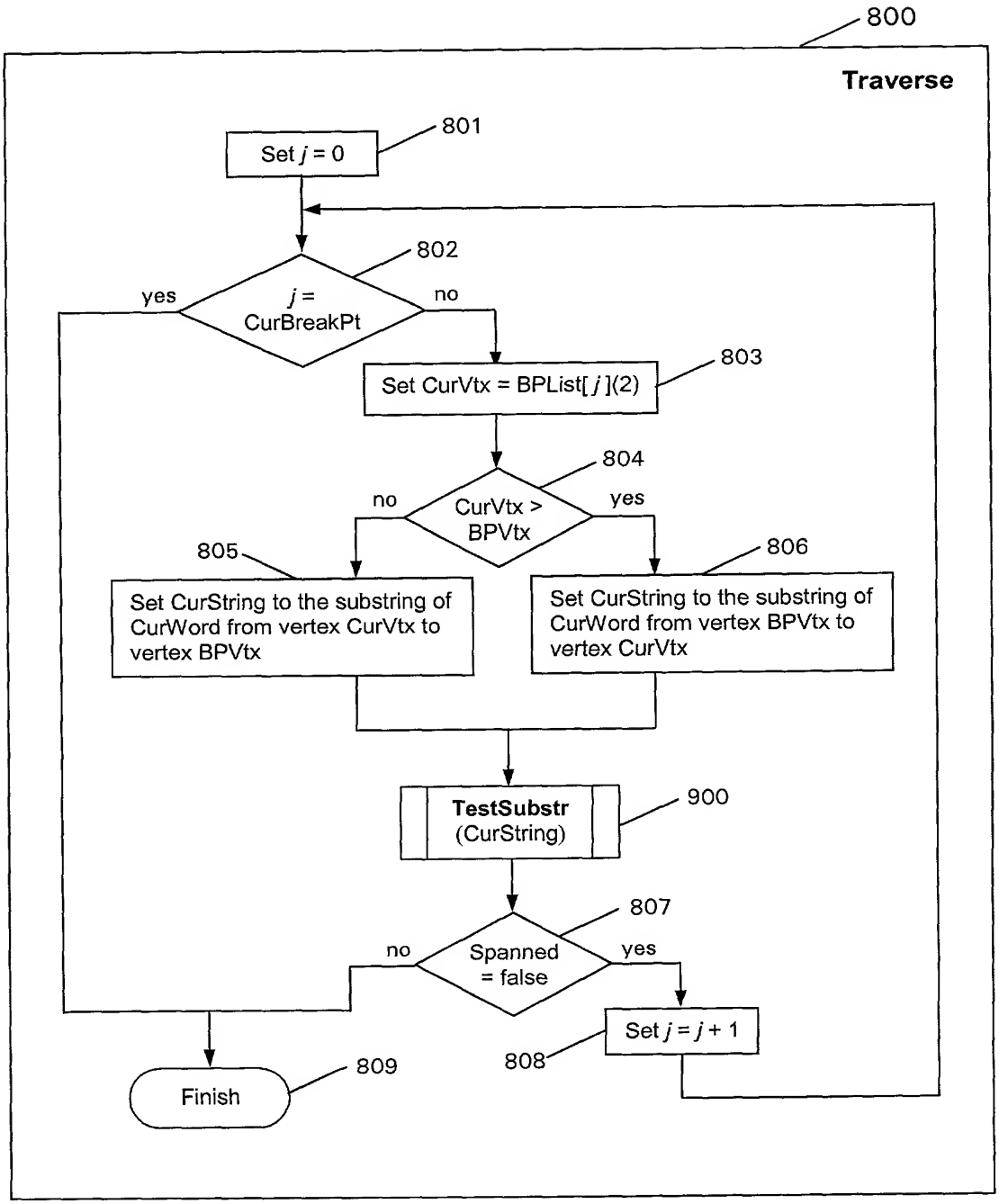

FIG. 14

Express Mail Label No. EL 929 628 470 US

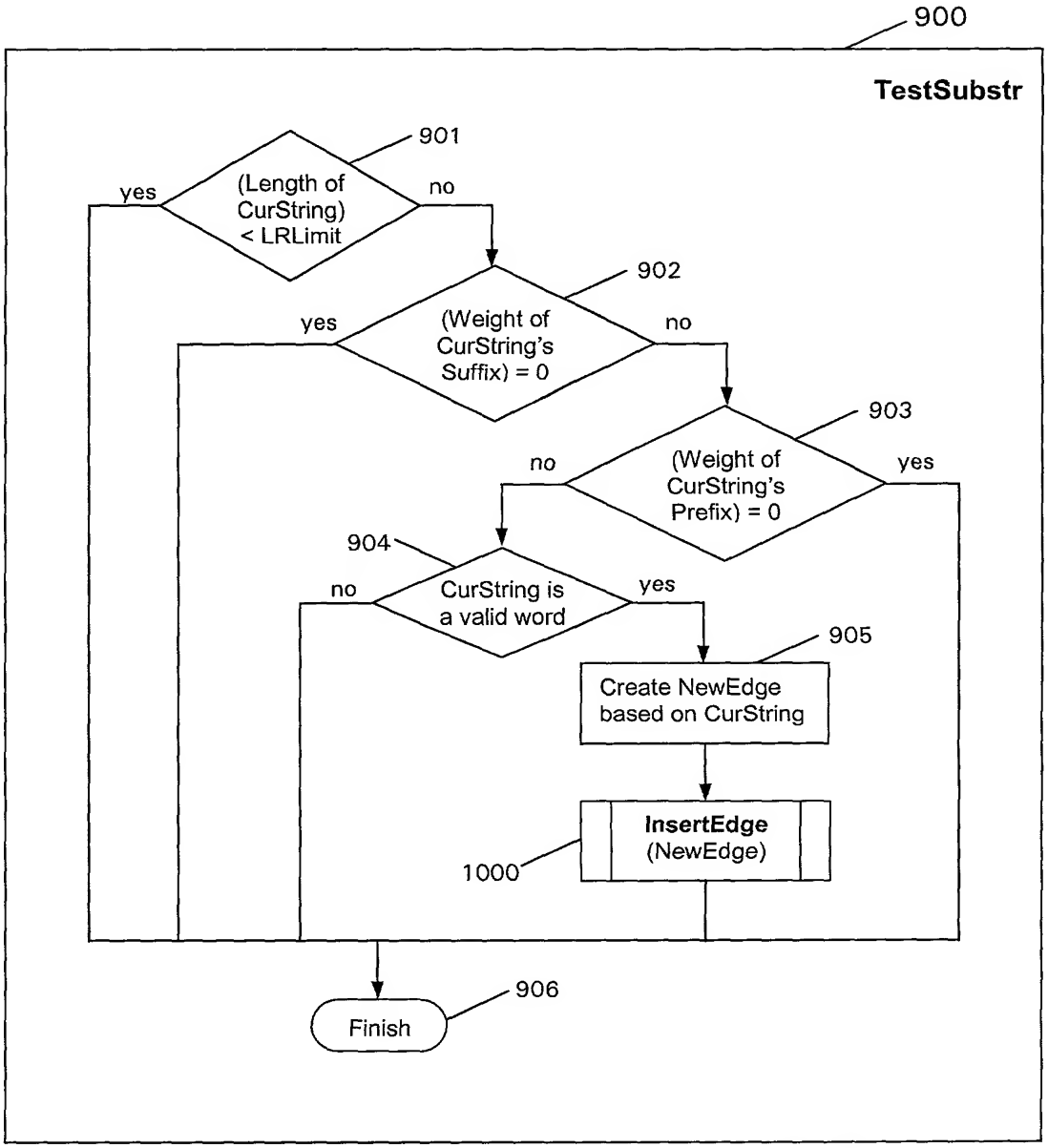
900
TestSubstr
901
(Length of CurString) < LRLimit
yes
no
902
(Weight of CurString's Suffix) = 0
yes
no
903
(Weight of CurString's Prefix) = 0
no
yes
904
CurString is a valid word
no
yes
905
Create NewEdge based on CurString
InsertEdge (NewEdge)
1000
906
Finish

FIG. 15

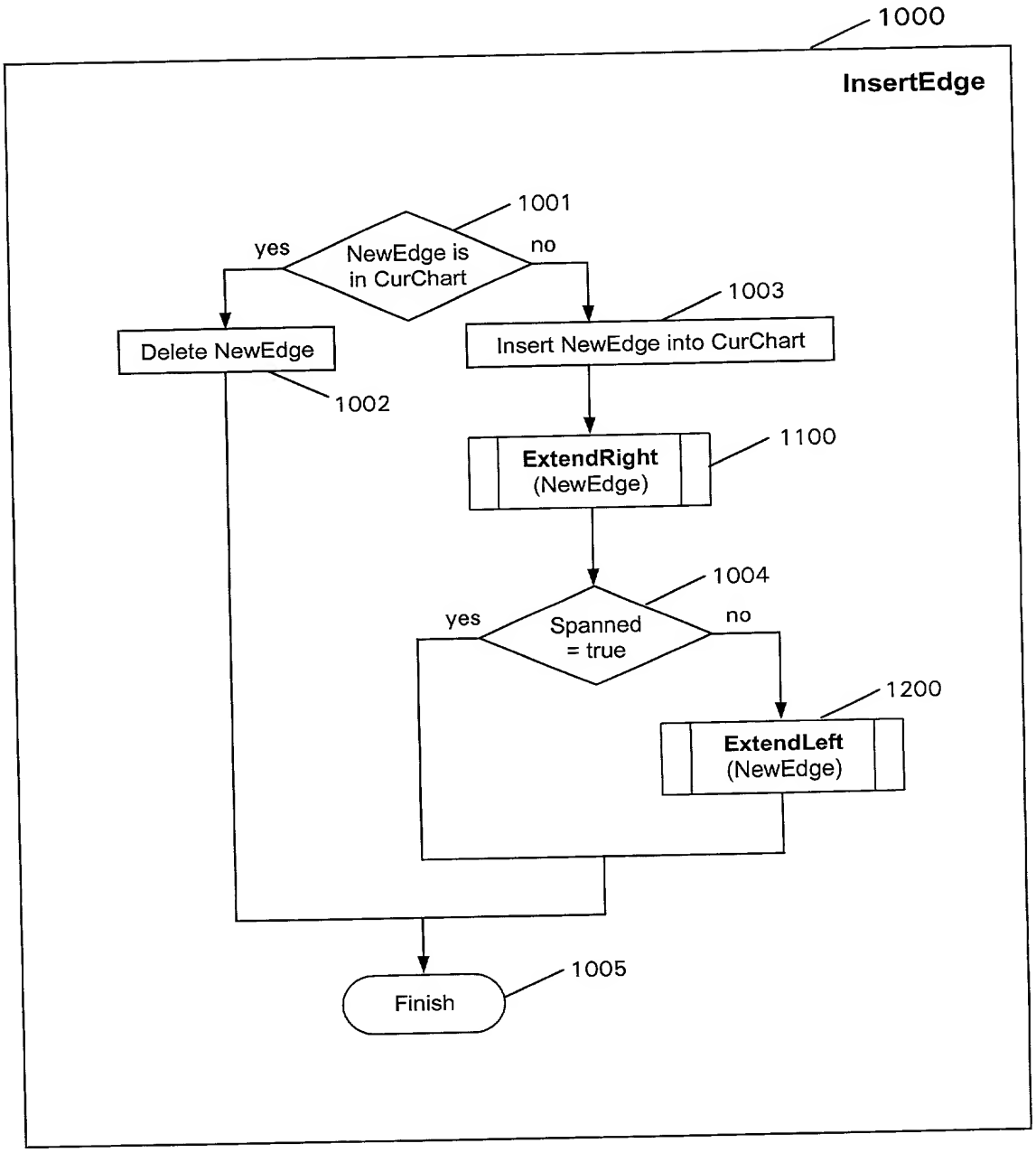
1000
InsertEdge
1001
NewEdge is in CurChart
yes
no
Delete NewEdge
1002
1003
Insert NewEdge into CurChart
ExtendRight (NewEdge)
1100
1004
Spanned = true
yes
no
1200
ExtendLeft (NewEdge)
Finish
1005

FIG. 16

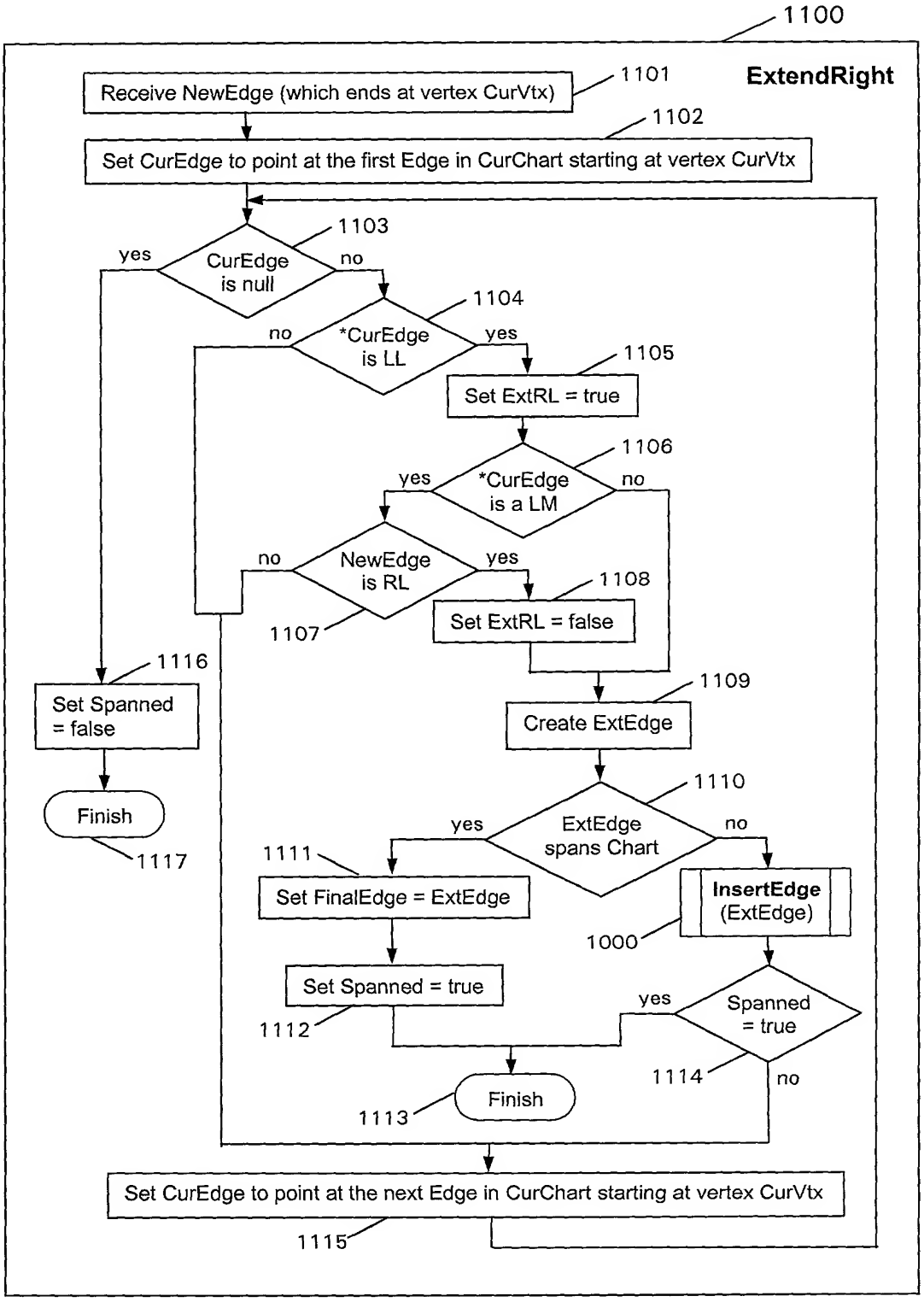
1100
ExtendRight
Receive NewEdge (which ends at vertex CurVtx)
1101
Set CurEdge to point at the first Edge in CurChart starting at vertex CurVtx
1102
CurEdge is null
1103
yes
no
*CurEdge is LL
1104
no
yes
Set ExtRL = true
1105
*CurEdge is a LM
1106
yes
no
NewEdge is RL
1107
no
yes
Set ExtRL = false
1108
Set Spanned = false
1116
Create ExtEdge
1109
Finish
1117
ExtEdge spans Chart
1110
yes
no
Set FinalEdge = ExtEdge
1111
InsertEdge (ExtEdge)
1000
Set Spanned = true
1112
Spanned = true
yes
no
1114
Finish
1113
Set CurEdge to point at the next Edge in CurChart starting at vertex CurVtx
1115

FIG. 17

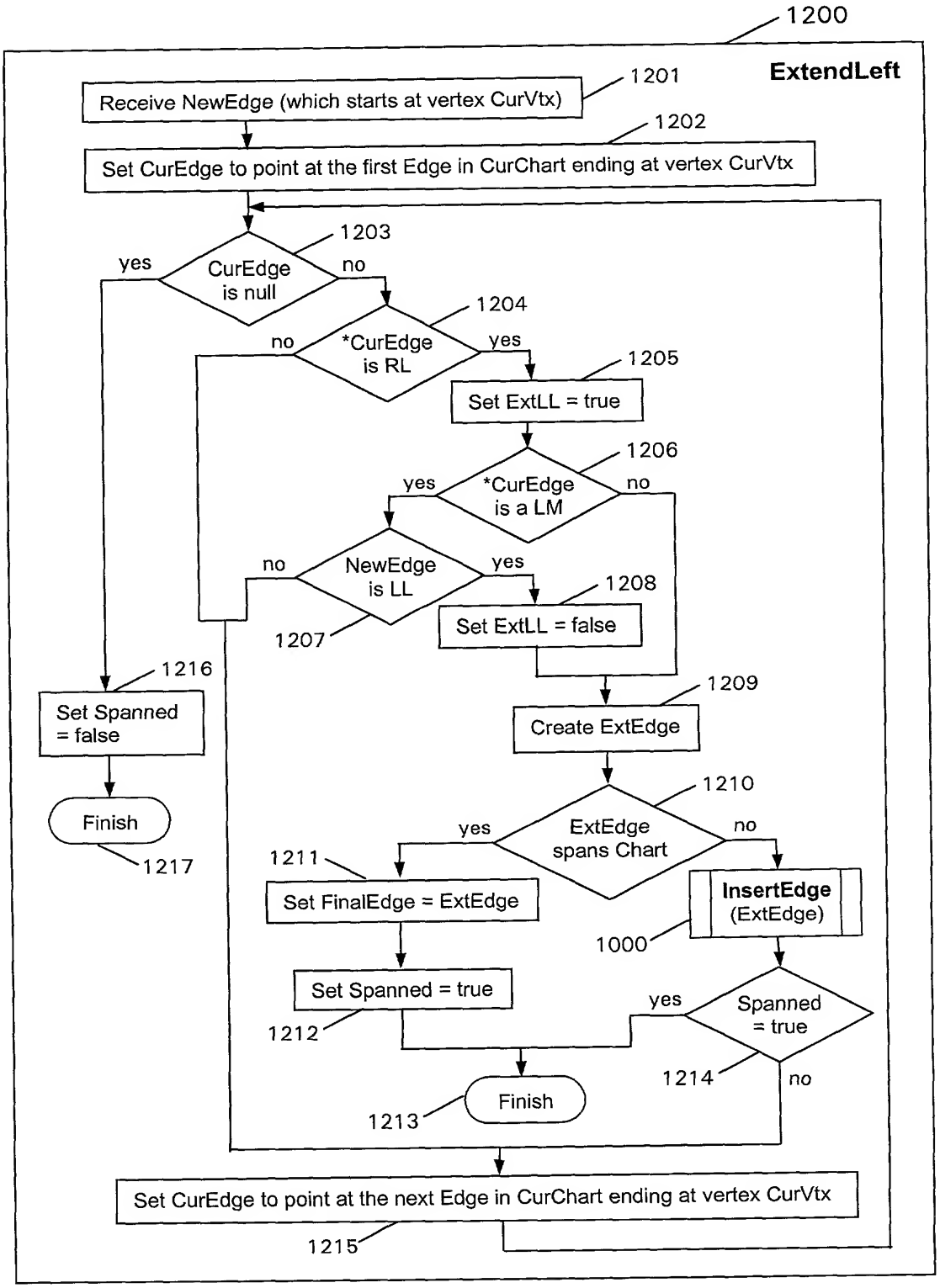
1200
ExtendLeft
Receive NewEdge (which starts at vertex CurVtx)
1201
Set CurEdge to point at the first Edge in CurChart ending at vertex CurVtx
1202
CurEdge is null
1203
yes
no
*CurEdge is RL
1204
no
yes
Set ExtLL = true
1205
*CurEdge is a LM
1206
yes
no
NewEdge is LL
1207
no
yes
Set ExtLL = false
1208
Set Spanned = false
1216
Create ExtEdge
1209
Finish
1217
ExtEdge spans Chart
1210
yes
no
Set FinalEdge = ExtEdge
1211
InsertEdge (ExtEdge)
1000
Set Spanned = true
1212
Spanned = true
yes
no
1214
Finish
1213
Set CurEdge to point at the next Edge in CurChart ending at vertex CurVtx
1215

FIG. 18

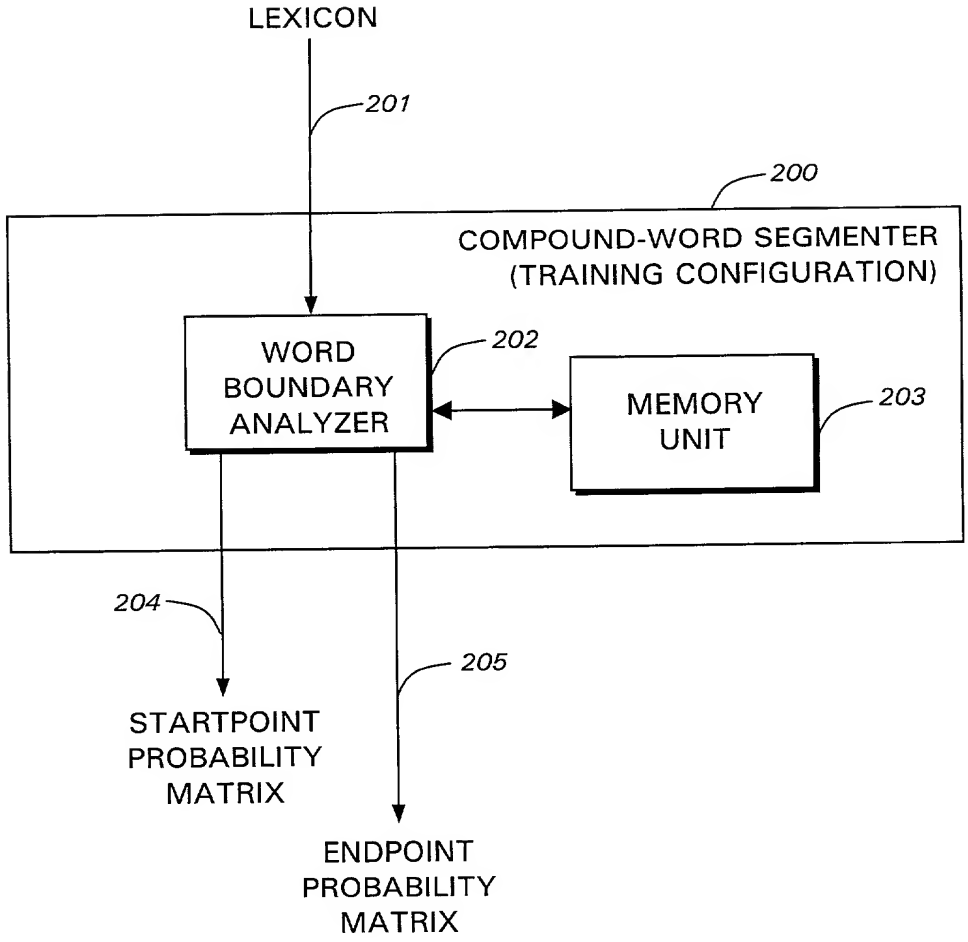
LEXICON
201
200
COMPOUND-WORD SEGMENTER
(TRAINING CONFIGURATION)
WORD
BOUNDARY
ANALYZER
202
MEMORY
UNIT
203
204
205
STARTPOINT
PROBABILITY
MATRIX
ENDPOINT
PROBABILITY
MATRIX

FIG. 19

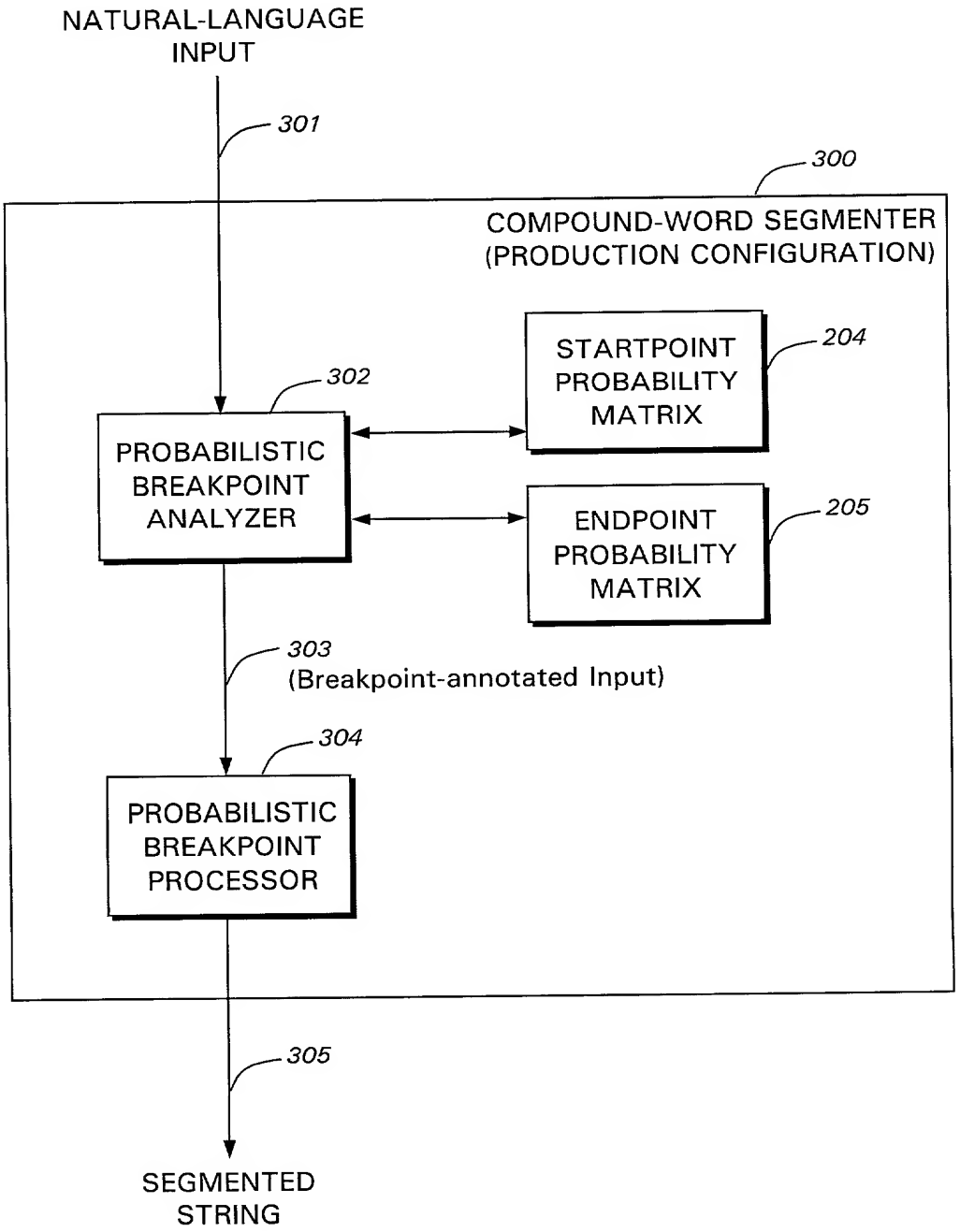
NATURAL-LANGUAGE INPUT
301
300
COMPOUND-WORD SEGMENTER (PRODUCTION CONFIGURATION)
STARTPOINT PROBABILITY MATRIX
204
302
PROBABILISTIC BREAKPOINT ANALYZER
ENDPOINT PROBABILITY MATRIX
205
303
(Breakpoint-annotated Input)
304
PROBABILISTIC BREAKPOINT PROCESSOR
305
SEGMENTED STRING

FIG. 20

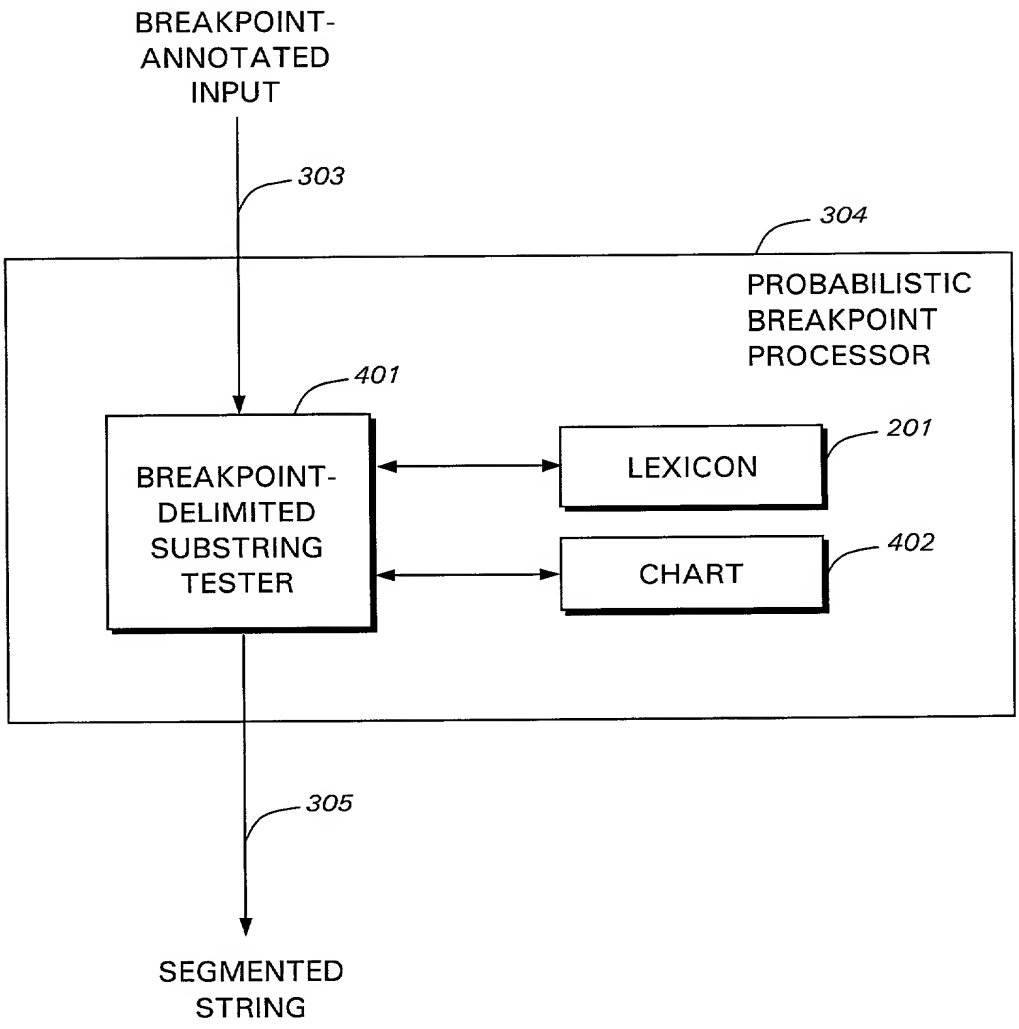
BREAKPOINT-ANNOTATED INPUT
303
304
PROBABILISTIC BREAKPOINT PROCESSOR
401
BREAKPOINT-DELIMITED SUBSTRING TESTER
LEXICON
201
CHART
402
305
SEGMENTED STRING

FIG. 21

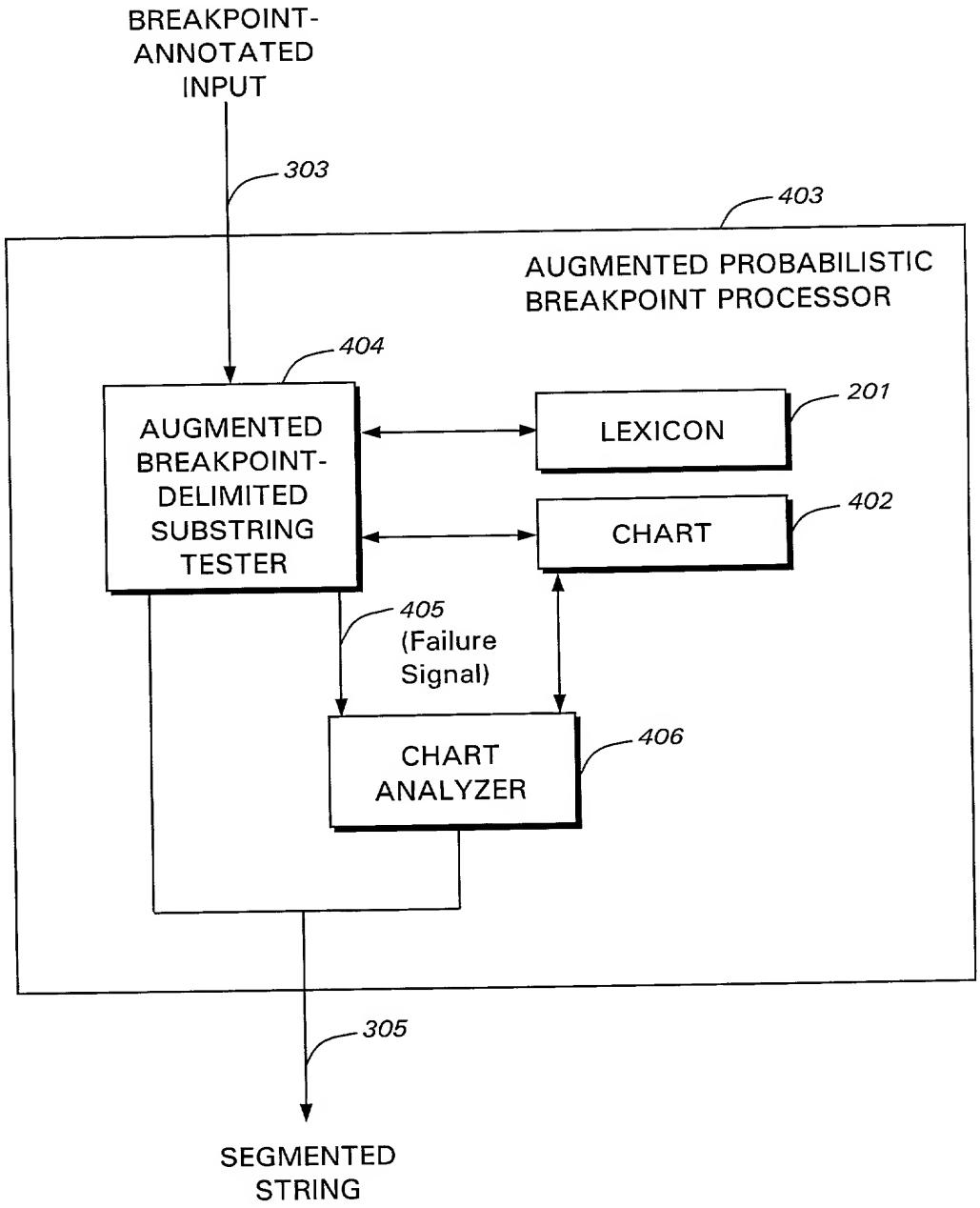
BREAKPOINT-ANNOTATED INPUT
303
403
AUGMENTED PROBABILISTIC BREAKPOINT PROCESSOR
404
AUGMENTED BREAKPOINT-DELIMITED SUBSTRING TESTER
LEXICON
201
CHART
402
405
(Failure Signal)
CHART ANALYZER
406
305
SEGMENTED STRING

FIG. 22